AN EVALUATION OF GEORGIA'S INSTITUTIONAL CONSERVATION PROGRAM
PRELIMINARY REPORT — JUNE 1989

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ABSTRACT

The Institutional Conservation Program (ICP) has been active in Georgia since 1980 and has distributed over $20 million in matching funds for conservation measures and energy studies. The purpose of the ICP is to reduce energy consumption in schools and hospitals and to foster active energy management through the grant process. This evaluation of Georgia's program provides a qualitative assessment of a majority of the grant recipient's post-grant behavior and the time dependability of installed conservation measures. The report includes a statistical summary of the program's grants from 1980 through 1986, program related information gained from grantee interviews, and a review of quality and effectiveness of implemented conservation measures. Suggestions to potential applicants and the state energy office for improving program success are also offered.

INTRODUCTION

The Institutional Conservation Program (ICP) has been an active program in the State of Georgia since 1980. The ICP is a federally supported grant program for public and non-profit hospitals, colleges, and schools to assist in administering and funding energy conservation studies and projects. Evaluation of Georgia's ICP had several purposes. Beginning in 1988, responsibility for administration of Georgia's ICP was transferred from the U.S. Department of Energy (DOE) to the Governor's Office of Energy Resources (GOER). The GOER contracted the Georgia Tech Research Institute (GTRI) to conduct an evaluation of previous grant years as a means to establish direction and increase vitality for the program. To date, no historical record of program recipients, implemented measures, actual versus estimated costs, or savings achieved had ever been compiled. A systematic evaluation offered the potential to quantify what the program had done and what had proved most successful during the program's history from 1980 through 1986. This period was selected, because the majority of grants funded after 1986 are still being implemented.

Several sources of information were used to evaluate the program. The DOE and GOER grant records, and DOE's Grant Tracking System (GTS) were used to determine who had been awarded grants, what measures were funded, and which grants were rejected. The DOE's final reports provided information on what was actually implemented at a site and how much each measure cost. Telephone interviews were conducted with each grant recipient to verify the final report, determine if all original measures were still functional, and collect program related information. Information on grants without final reports was obtained through telephone interviews where possible. Based upon the interview results, a representative sample of recipients was selected for on-site visits. Site visits permitted verification of interview data, insight into Energy Conservation Measure (ECM) implementation methodology, determination of ECM installation quality, and formulation of factors common in successful installations.

To date, DOE and state records have been reviewed, the grantee interview process is complete, and 23 on-site investigations have been conducted. An additional 16 on-site investigations are planned before a final report is submitted to the GOER in September 1989.

This preliminary report includes a statistical summary of ICP grants from 1980 through 1986, program-related information gained from grantee interviews, and a review of the quality and effectiveness of implemented conservation measures. Also included are recommendations for improving the success rate and acceptance of future ICP grant cycles.

STATISTICAL SUMMARY

The initial part of the evaluation involved a statistical analysis of the DOE and state grant records. Information on the number of buildings, location, type of institution, funded measures, and estimated and actual costs was obtained. From 1980 through 1986, there were 160 grant awards totalling approximately $22 million in matching funds to implement energy conservation measures. The program funding was approximately $11 million with an $11 million match by grantee recipients. Of the 160 grants, 18 grants with a total of $0.7 million in matching funds were rejected by the grantees. The types of measures funded appear in Exhibit 1. Also during this period, 102 grant awards for Technical Assistance Studies (TAs) totalling approximately $1.7 million were made. The information in this summary, however, only includes grants for energy conservation measures. The average payback for all accepted grants was 2.3 years resulting in an estimated annual energy

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TABLE 1
MEASURES FUNDED BY TYPE

	Envelope	Lighting	Mechanical	Renewable	EMS	Total
Total Funded	298	370	601	37	297	1601
% of Total	19	23	38	2	19	100
$ Funded (Millions)	1.5	1.9	6.1	2.2	5.7	17.4[1]
% of Funding	9	11	35	13	33	100
Avg. Fund ($/Measure)	5,000	5,100	10,100	74,500	19,200	10,800
Cost Ratio (Act./Est.)	135%	92%	103%	152%	118%	115%

[1]Note: Data excludes $4.6 million in ECM implementation as no data were available.

savings of 1,009,500 MMBtu, and an estimated annual cost savings of $9.3 million.

During this period, the grants comprised an average of 5.9 buildings per grant. The average dollar amount of the grants was $168,750. On a per building basis, the dollar amount funded was $28,600.

The DOE and GOER data reveals that mechanical ECMs were the most popular. This group comprised 38 percent of the total number funded and would have comprised over 50 percent if energy management, which is a sub-class of this group, was included. Mechanical measures include fuel conversions, duct or pipe insulation, variable air volume, stack economizers, temperature reset devices, and boiler replacement.

The second largest group of conservation measures was lighting changes. This includes fluorescent, high intensity discharge or other high efficiency sources conversions, fixture modification, ballast disconnection, and other lighting modifications.

Building envelope measures were only slightly greater than the mechanical sub-group energy management systems. Building envelope measures can include double or triple glazing of windows, storm windows, blocking-in windows, wall insulation, ceiling insulation, infiltration control, or vestibules.

Renewable energy conversions were by far the smallest class comprising only two percent of the total number funded. Prominent measures within this group include wind, biomass, refuse, and other renewable conversions; solar space conditioning; photovoltaic; solar water heating; and geothermal.

The amount of money devoted to different types of measures is also shown in Table 1. Mechanical measures dominate, especially if energy management systems are factored in. If energy management systems are combined with the other mechanical measures, the funding is over 65 percent of the total. Building envelope measures, which can be among the most costly, received the smallest share. Although renewable energy measures were the least frequent in number of occurrences, they were third largest in total funding due to their high unit cost. Envelope measures had the lowest overall funding with only nine percent of the total.

Grant records also included information on estimated and actual funding. This yields insight into the anticipated costs of various measures, and the accuracy of cost estimates included in the technical analysis reports. Typically, the estimated costs were less than the actual costs. The most inaccurate estimates were for the renewable energy measures which are also the most costly. Renewable measures tend to be unique, thus there is less historical data from which to generate accurate estimates. Of the frequent measures, building envelope cost estimates were the most inaccurate. Mechanical measure estimates were miscalculated by an average of three percent (See actual to estimated cost ratios in Table 1). A sub-class of mechanical measures, energy management systems, was low by an average of 18 percent. Lighting measures were the only conservation measure overestimated. The average overestimate for lighting was eight percent. When all the conservation measures are combined, cost estimates run low by an average of 15 percent.

The type of measure should and does have an effect on the accuracy of the estimated cost. Some measures can have their scope of work adjusted to agree with the available funds while others have more fixed scope of work. Although lighting measures usually do not have their scope of work

changed, they are the easiest to estimate because the number of fixtures is clearly defined and installation is straight forward because the wiring is accessible and open to inspection. These factors influence the accuracy of the cost estimates.

Despite the fact that the material and installation costs of mechanical measures are often difficult to accurately estimate, the cost estimates calculated for the ICP technical assistance reports proved quite accurate. This can be attributed to the simplicity of some mechanical measures and their relative ease of estimation or variability of the "scope of work," i.e., the installation can be adjusted to the available funding. Energy management systems can have their "scope of work" and installation costs adjusted by changing the number of control points and number of zones. Although reducing control points will not provide the same degree of control as originally specified, the EMS will be functional, and some energy savings will accrue.

Building envelope and renewable energy measures demonstrated the most inaccurate cost measures, an incidence attributed to the complexity of these measures. Unlike measures in the other groups, envelope and renewable energy systems are difficult to estimate because the material and installation requirements can not be accurately assessed until the project is begun. The inherent complexity of these measures increases the likelihood that pertinent features may be overlooked and excluded from the estimate. Also, the "scope of work" for these measures may not lend itself to adjustment.

The average amount funded for each major type of measure is also presented in Table 1. As expected, renewable energy measures were the most expensive averaging almost four times more than the next most expensive measure. The cost of energy management systems was the most expensive of the frequently installed measures at an average cost of $19,200.

The average funding for the remaining mechanical measures was $10,100. The average cost for lighting and building envelope measures was just over $5,000. This appears to be reasonable for lighting but would be appropriate for only the simplest envelope-related measures.

The frequency of occurrence of specific measures by group is presented in Table 2. The mechanical group had the largest number of funded ECMs followed by lighting, envelope, and renewable energy measures. Within the mechanical group, the most frequently implemented ECM was energy management systems. For lighting, the most frequently implemented ECM was converting incandescent to fluorescent lamps. The most frequent building envelope measure was roof/ceiling insulation. The most frequent renewable energy measures were solar hot water heaters.

The two most frequently occurring measures - energy management systems and fluorescent lighting conversions - constitute over one-fourth of the total number funded during the 1980-86 period. The nine measures listed in Table 2 represent over half of the measures funded under the program. The remaining 66 measure classifications contain only 48 percent of the measures funded.

Table 3 presents the distribution of grant awards by type of building and also shows the amount of grant duplication, i.e., sites received multiple grants during the period. The duplication of grants was relatively low, only 28 out of 160 or 18 percent. As was the case with frequency of grants, schools and colleges also received the largest funding. During the period under consideration, school and colleges were awarded over three-fourths of the available grant funds. Hospitals accounted for almost 20 percent of the conservation measures funded when frequency is considered, but they received only 13.6 percent of the available grant dollars distributed. This is surprising since hospitals were allowed to receive up to 30 percent of each years available funds and hospital ECMs generally have a shorter payback due to long operating hours.

TABLE 2
FREQUENCY OF CONSERVATION MEASURES BY GROUP

Group	Measure	Number	% of Total
Mechanical	Energy management	375	18.5
	Reduce Air Volume	114	5.6
	Auto Flue Damper	77	3.8
Lighting	Fluor./Incand.	118	8.9
	Other High Eff.	95	4.7
Envelope	Ceiling/Roof Insul	130	6.4
	Storm Windows	75	3.7
Renewable	Solar hot Water	15	0.7
	Geothermal	10	0.5

TABLE 3
DISTRIBUTION OF GRANTS BY BUILDING TYPE
(1980-1986)

Total # Grants	Schools	Colleges	Hospitals	Other	Total
1	55	38	29	10	132
2	8	7	2	0	17
3	6	3	0	0	9
4	1	1	0	0	2
Total Rec'd	70	49	31	10	160
% Rec'd	44%	31%	19%	6%	100%
Total Fund ($ Millions)	7.9	9.0	3.0	2.1	22

The geographic distribution of ICP grants during the 1980-86 period is appears in Table 4. The range of grants received ranged from a high of 16.9 percent of the total to a low of 6.9 percent. The lowest number of grants received was shared by two

congressional districts. A perfect geographic distribution among the 10 districts would have each one receiving 16 grants or 10 percent of the total. Although this was not the case, the distribution achieved seems equitable given the constraints of the program. It was originally believed that congressional districts around the metropolitan Atlanta area were the greatest recipients of ICP grants; however, this is not supported by the data. The Seventh District was the largest beneficiary of the program. The southern part of this district is Cobb county but the north contains Rome and Dalton and is largely rural. The Fifth district which includes the City of Atlanta, received 11.9 percent of the grants. This is only slightly over 10 percent, a level which would give each district an equal number of grants. The Fourth District which includes east Atlanta and Decatur with only 6.9 percent shared the title for fewest grants.

TABLE 4
GEOGRAPHIC DISTRIBUTION OF ICP GRANTS: 1980-1986

Congr. Dist.	School	College	Hospital	Other	Total	%
1	7	4	2	0	13	8.1
2	6	2	4	0	12	7.5
3	4	4	2	1	11	6.9
4	4	4	1	2	11	6.9
5	3	10	3	3	19	11.9
6	10	2	2	0	14	8.7
7	13	6	7	1	27	16.9
8	3	7	3	2	15	9.4
9	9	5	6	1	21	13.1
10	11	5	1	0	17	10.6
Totals	70	49	31	10	160	100.0

PARTICIPANT *INTERVIEWS*

The second phase of the evaluation was a detailed telephone survey of each recipient. The purpose of the phone interview was to locate a site person familiar with the grant, collect baseline information on the success of each measure funded, and determine each participant's general evaluation of the program. Of the 98 institutions that accepted a grant, 75 were successfully interviewed. Based on the results of these interviews, candidates for site investigations were identified.

Results of the program-related questioning are presented in Table 5. In addition to providing insight into the participant's perception of the grant program, it was designed to determine if program participation had any long-term implications for energy management. Ideally, the grants were supposed to serve as seed money, nurturing a deeper energy conservation commitment at each facility.

The program-related responses revealed relatively consistent results among the participants. The lowest affirmative answers concerned questions regarding a planned energy conservation program and implementation of non-funded measures. Both of these seem to indicate that the urgency of energy conservation has declined during the late 1980s. Although nearly three-fourths of the respondents indicated they have an energy conservation program, the majority of these programs involved only short term objectives such as "we need to insulate that building" or "we're expanding our EMS system". Long term goals like alternate fuels, transport gas, demand management, etc., were seldom considered.

One of the intended benefits of the ICP in funding ECMs was to encourage the grantees to invest in further facility efficiency improvements. This appears to be the case since nearly 75 percent have implemented additional measures in the same facilities.

TABLE 5
PROGRAM RELATED QUESTIONS

Program Related Question	Affirmative Responses	Percent Affirmative
Track Energy Consumption?	65	87%
Active Conservation Program?	54	72%
Implement Non-funded Measures?	54	72%
Include Energy Conservation Spec's?	70	93%
Plan Future Participation?	65	86%

The highest affirmative response of 93 percent was regarding whether energy conservation is a significant factor in renovation or new construction. Also, over 80 percent of the respondents said they track energy cost and consumption and they *plan* future participation in the program. In some cases, a comprehensive utility report is generated from an energy management system computer. Many sites however still record energy cost with pencil and paper. Although they routinely record energy cost, many sites do not record consumption, nor do they calculate and track Energy Use Indexes (EUI) and average energy cost. Those sites logging only cost were however were given credit for tracking energy.

Over 80 percent indicated they would consider future participation in the program. Before the evaluation, there was some concern that the rigorous rules regarding preparation of grant applications and allowable measures and the stringent reporting requirements would dampen participant enthusiasm. This was not reflected in the interviews because almost three-fourths of those surveyed indicated that they had grants under

consideration or would consider application in the future.

A final question asked participants was for suggestions on program improvement. Only 47 percent of those questioned offered suggestions which indicates a high level of satisfaction with the program. Table 6 presents a summary of the responses.

The most common program deficiency noted was excessive paperwork. More than one out of every five participants felt this was a problem. Many were resigned to the fact that some level of reporting is necessary to insure proper operation of the program. It should be noted that although many participants felt the paperwork was too great, the degree of record keeping demanded of grant recipients has been much less than that originally agreed upon. For example, the program specifies that three years of energy consumption records should be submitted following implementation of the conservation measures. Our examination of DOE final report files found no instances of this actually being performed.

TABLE 6
SUGGESTIONS FOR PROGRAM IMPROVEMENT

Suggestion or Reason	Percent of Respondents
Too much paperwork	22%
Not enough money available	8%
Too many Gov't restrictions	4%
Other	13%
No suggestion offered	53%

The "other" category contained additional suggestions. One predominant suggestion in this category concerned the Davis-Bacon requirements which says all contracting be with union labor. At least three respondents named repeal of the Davis-Bacon requirement as a major improvement for the program. Management personnel reported that Davis-Bacon can increase the labor costs of installing ECMs up to 50 percent. Often, administrators must use internal labor to avoid this cost.

Another common complaint was the quality of the Technical Assistance Reports prepared for the facilities. Managers noted that the reports often contain non-feasible items. A common suggestion for improvement was to enlist more local involvement in study preparation. At least two respondents remarked that the ECMs suggested were not necessarily the best or the ones which save the most energy. They felt measures were included in the report because only a narrow range of paybacks are funded, and those measures above a certain threshold payback level are intentionally discarded. Based on the suggestions offered to them for conservation improvements, several recipients questioned the allegiance of TA analysts. At least two questioned the cost of TA report preparation noting it was a high price to pay to determine the obvious. In one case, one manager decided to forego the $10,000 cost for a TA study and instead used internal funding to install lighting reflectors needed in a library.

The final area surveyed was the success of the installed energy conservation measures (See Table 7). Success was determined by whether the measure remained active, and whether, in the grantee's view, the measure was performing satisfactorily. The number of measures still active was expected to provide insight into overall program effectiveness and energy savings.

A surprisingly high percentage (over 93 percent) of the energy conservation measures installed were still active and were considered performing satisfactorily when the facilities were surveyed. The seven percent of inactive measures accounted for 8 percent of the total funding. The only two areas of concern are energy management systems and renewable energy projects such as solar hot water and incinerators.

The 64 inactive energy management system ECMs constitute only nine individual systems. Of these nine, five were disconnected because in the grantee's view the system never worked properly. One system was by-passed because the grantee lost the central computer with the break-up of a school system and a community college. Two systems are inactive because of maintenance problems. One system was disconnected because current maintenance personnel were not trained to operate the system. Of the two solar hot water systems found inactive, one was disconnected after numerous operational problems and the other was damaged by a heavy snowfall. The inactive incinerator system was shut down due to numerous mechanical breakdowns and resulting high repair costs. Maintenance costs on this system also were much higher than expected.

TABLE 7
INACTIVE ENERGY CONSERVATION MEASURES

ECM	# Inactive	# Reviewed	% Inactive
Energy Mgt System	64	248	26%
Solar DHW	2	11	18%
Other Heating Mods.	1	41	2%
Incinerator	1	4	25%
Lighting Changes	7	55	13%
Other Control Device	1	22	5%
Other Shutdown Device	1	22	5%
Fluorescent Conversion	1	122	1%
All Other ECMs	0	625	0%
TOTALS	78	1150	7%

ON-SITE INVESTIGATIONS

Of the 75 grantees interviewed, 23 on-site investigations have been conducted, 16 more are planned. The purpose of the site visits is to verify interview data, gain insight into ECM implementation methodology, determine quality of ECM installations, and formulate factors common in successful installations.

Of the 23 investigations conducted thus far, there have been no deviations from the interview data obtained by telephone. This increases our confidence in the data obtained from all the telephone interviews.

In terms of ECM implementation, a large variety of methods to accomplish the same measure were apparent. This is especially true for blocking-in of window areas, a common measure for schools systems. In one school system alone, more than four methods were used depending on building type. This was also true for energy management systems. Some systems took complete control over mechanical systems while others operated more as centralized time clocks.

The quality of ECM installation was found to be higher than expected. Because of the cost constraints on the grants, it was expected that some short-cuts would be taken. This appears not to be the case. Even when the grant funding was not adequate, the grantee either added additional funding, used in-house labor, or made a design change to ensure that the installation was of high quality. Based on a review of the TA studies for these grants, the ECM descriptions were not very detailed. This left a great deal of interpretation open to the grantee for how the ECM should be implemented. The grantees worked well within these descriptions to implement high quality conservation measures. On many occasions, a funded ECM was deemed to be impractical upon implementation. In these cases, the grantee requested that the grant be used for other measures. After the grantee supplied energy-saving documentation for the change, DOE and the state would approved it.

PRELIMINARY CONCLUSIONS

Georgia's Institutional Conservation Program has satisfied its primary objective to install energy conservation measures that improve the long-term efficiency of institutions throughout the state. Reviews have shown that the measures installed are both long-lasting (93 percent still active) and of high quality. In addition, the vast majority of grantees took a direct interest in the ECM implementation phase and made sure that what was implemented was right for the particular institution. One major area for concern is grants for energy management systems which were found to have a failure rate of 26 percent. Cost estimates have been satisfactory with the exception of envelope and renewable energy measures. Grantee interviews have shown overall satisfaction with the program, and over 85 percent plan to participate in future grant cycles.

Three recommendations for program improvement can made at this time. One is to set minimum standards for both TA study description and calculations for particular ECMs, especially energy management systems. Another is establish a point system to allow higher priority on certain types of ECMs which show a high success rate and which have a long life span, such as envelope measures.

Third, long-term energy conservation at Georgia's institutions can result only when the institution has a comprehensive program of energy management. Therefore, the TA Study requirements should be changed to emphasize education of grantees in energy management techniques rather than just the calculation of the most short term cost effective ECMs.